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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 20 December 2002 with an application for Letters Patent number 523300 made by DAVID JOHN MICHAEL GIBSON AND TERENCE DONALD BANNISTER.

I further certify that pursuant to a claim under Section 24(1) of the Patents Act 1953, a direction was given that the application proceed in the name of BRYHER HOLDINGS LIMITED.

Dated 8 January 2004.

Neville Harris

Neville Harris
Commissioner of Patents, Trade Marks and Designs

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NEW ZEALAND PATENTS ACT 1953

PROVISIONAL SPECIFICATION

PERISTALTIC PUMP HEAD AND TUBE HOLDER

I, DAVID JOHN MICHAEL GIBSON, a New Zealand citizen of 59 Standen Street, Karori, Wellington, New Zealand, and TERENCE DONALD BANNISTER, a New Zealand citizen of 22 Apu Crescent, Lyall Bay, Wellington, New Zealand, do hereby declare this invention to be described in the following statement:

PERISTALTIC PUMP HEAD AND TUBE HOLDER

FIELD OF THE INVENTION

The invention relates to a peristaltic pump head for pumping fluids, and to a tube holder for use in a peristaltic pump head.

BACKGROUND OF THE INVENTION

A large number of applications require the pumping of fluids. Standard pumps result in the fluid coming into contact with the pumping apparatus, thereby risking contamination of the fluid. Peristaltic pumps operate by occluding a tube containing the fluid, so that the fluid only comes into contact with the interior of the tube, and not the pumping head or other pumping components.

One problem faced with conventional peristaltic pumps is maintaining the tube in a desired position within the tube race, as if the tube moves with movement of the pumping head, the fluid will not be pumped efficiently.

Another issue with conventional peristaltic pumps is maintaining correct alignment between the pump head and the tube in the raceway, and maintaining the desired pressure on the tube for consistent fluid pumping.

It is an object of at least a preferred embodiment of the present invention to provide a peristaltic pump head and/or tube holder which address at least one of the issues outlined above and/or which at least provides the public with a useful choice.

SUMMARY OF THE INVENTION

In a first aspect, the invention broadly consists in a tube holder for use in a peristaltic pump, the tube holder including: a housing defining a recess for receipt of a pump rotor, a

tube race for receipt of a tube defined around the recess and having a first race part around one part of the recess and a second race part around another part of the recess, a first tube inlet into the first race part and a first tube outlet from the first race part, a second tube inlet into the second race part and a second tube outlet from the second race part; the tube being insertable in the tube race by movement in a direction substantially orthogonal to the tube race so that it extends in through the first tube inlet, around the first race part, out through the first tube outlet, in through the second tube inlet, around the second race part, and out through the second tube outlet.

The first tube outlet and second tube inlet may be configured such that the tube can exit the housing between the first outlet and second inlet. Alternatively, the first tube outlet and second tube inlet may be in communication with a recess or groove or similar which is separate to the tube race, but which is located within the housing.

Preferably, the housing includes a lip or projection between the first outlet and the second inlet, behind which the tube can be located to maintain the tube in position within the tube race.

The recess is preferably tapered for receipt of a substantially frustoconical pump rotor. Each tube race part is suitably defined by a channel or groove extending inwardly from a respective tube inlet and tube outlet, and which grooves preferably extend part way around the recess. While the grooves could be configured to meet around the recess, it is preferred that the grooves do not meet, so that a tube extending through the grooves will extend around part of the frustoconical surface of the recess. The recess thereby provides surfaces against which the tube is occluded to pump fluid therethrough in use.

The tube holder is preferably a one-piece article, which is most preferably made from an injection moulded polymer plastic for example.

In a second aspect, the invention broadly consists in a method of assembling a peristaltic pump head including: providing a tube holder having a housing defining a recess for

receipt of a pump rotor, a tube race for receipt of a tube defined around the recess and having a first race part around one part of the recess and a second race part around another part of the recess, a first tube inlet into the first race part and a first tube outlet from the first race part, a second tube inlet into the second race part and a second tube outlet from the second race part; providing a tube; and moving the tube in a direction substantially orthogonal to the tube race such that it extends in through the first tube inlet, around the first race part, out through the first tube outlet, in through the second tube inlet, around the second race part, and out through the second tube outlet.

The tube holder may have any one or more features outlined in respect of the first aspect above.

Preferably, in the embodiment in which the tube holder includes a retainer which is preferably in the form of a projection or lip between the first outlet and the second inlet, the method further includes pulling the installed tube in a direction away from the retainer so that the tube is maintained in position within the tube race with part of the tube located behind the projection or lip.

The tube may be loaded into the tube holder manually, or may be loaded via a suitable machine.

The method preferably further includes bringing the tube holder into engagement with a pump rotor so that the pump head is located in the recess in the tube holder.

In a third aspect, the invention broadly consists in a peristaltic pump head assembly including: a tapered pump rotor rotatably mounted in or on a pump head housing and which is rotatable about an axis of rotation relative to the housing; and a tube holder including a recess in which the pump head is receivable and including a tube race for receipt therein of a tube for pumping of a fluid by movement of the rotor; the tube holder mountable to the pump head housing so it can float in a direction transverse to the axis of

rotation of the rotor, the pump rotor and tube race self-aligning as a result of the tapered rotor extending into the recess of the floating tube holder.

The tube holder may be of a type in which the tube may be inserted into the tube race from one or more ends of the holder, such that the holder and pump head housing need not be separable to load the tube.

Alternatively, and in a preferred embodiment, the tube holder and pump head housing may be separable so that they are moveable from an operable configuration in which the pump head is located in the recess of the tube holder and configured to pump fluid through a tube therein to a loading configuration in which the tube may be loaded into the tube race. The tube holder and pump head housing are preferably fully separable. In these embodiments, the tube holder is preferably of the configuration outlined in a first aspect above. Alternatively, the tube holder may have a different configuration in which the tube may be woven in and out of the tube holder housing to maintain the tube therein during pumping.

In a preferred embodiment, the tube holder has a housing, a first tube race part around one part of the recess defined by a first tube inlet aperture and a first tube outlet aperture, and a second tube race part around another part of the recess defined by a second tube inlet aperture and a second tube outlet aperture, such that movement of a tube threaded therethrough in the axial direction of the rotor is minimised or prevented by the apertures.

The rotor is preferably axially biased towards its tapered end, such that the pump rotor and tube race are self-adjusting, to maintain a desired pressure on a tube in the tube race during pumping. The biasing device is preferably a compression spring. A stop may be provided on the rotor to limit its axial movement relative to the housing. The stop is preferably in the form of an annular lip.

All of the components of the peristaltic pump head assembly are most preferably made of a polymer plastic material, although it may be desirable for the spring to be made of spring steel for example.

The rotor is most preferably substantially conical or frustoconical, and may have a plurality of rollers rotatably mounted thereon which are configured to occlude the tube in use. It is not essential that rollers be provided in the rotor, as fixed members could be used to occlude the tube if a suitable self-lubricating material such as nylon is used. In the embodiment using rollers, they are preferably substantially frustoconical in configuration, with their tapered ends directed towards the tapered end of the rotor, and most preferably mounted for rotation with axes which also taper toward the tapered end of the rotor.

The rotor suitably includes a main body part and a head part, with the rollers mounted for rotation in a recess or recesses between the main body part and the head part. The biasing device preferably acts against a pusher which pushes against the underside of the rotor head part. The rotor preferably includes three rollers, which are most preferably evenly spaced about the central axis.

The pump head housing may also include a transmission mechanism for transmitting motive force to the rotor. The transmission suitably includes a plurality of engaged gears, one of the gears being engaged with the rotor and another of the gears being configured for engagement with a drive mechanism such as an electric motor or similar. The rotor body could have a toothed periphery for this purpose. The teeth are preferably of a sufficient length that they remain engaged with the teeth on an adjacent gear throughout the range of axial motion of the rotor in its axially biased configuration. An alternative transmission mechanism such as pulleys and bands or gears and chains could be used if desirable.

In a fourth aspect, the invention broadly consists in a peristaltic pump head assembly including: a tapered pump rotor which is rotatable about an axis of rotation; and a tube

holder including a recess for receipt of the tapered end of the rotor, and a tube race for receipt therein of a tube for pumping of a fluid by movement of the rotor, the tube race including a plurality of separate race parts around the recess defined by a plurality of apertures or recesses such that the tube can exit and re-enter the tube race.

The pump head assembly may have any one or more features of the third aspect above.

In a fifth aspect, the invention broadly consists the combination of a pump rotor rotatably mounted in or on a pump head housing and which is rotatable about an axis of rotation relative to the housing; and a tube holder including a recess in which the pump head is receivable and including a tube race for receipt therein of a tube for pumping of a fluid by movement of the rotor; the pump head housing and tube holder being fully separable from an operable configuration in which the pump head is located in the recess of the tube holder and configured to pump fluid through a tube therein to a loading configuration in which the tube may be loaded into the tube race.

In a sixth aspect, the invention broadly consists in a kit of parts for assembling a peristaltic pump head assembly, including a rotor and a housing having first and second housing parts and configured for receipt of the rotor; which rotor may be maintained in the housing by snapping the housing parts together such that the pump head assembly can be assembled without the use of adhesives or separate fasteners.

The rotor may be provided in kit form, and may include a main body part, a head part and at least one roller, which may be assembled by snapping the main body part and head part together to sandwich the roller(s) therebetween.

In a seventh aspect, the invention broadly consists in a kit of parts which can be assembled into the pump assembly of the third or fourth aspects above.

The combination of the fifth aspect and the kits of the sixth and seventh aspects may have any one or more of the features of the other aspects outlined above.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

The invention consists in the foregoing and also envisages constructions of which the following gives examples only.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present invention will be described by way of example only with reference to the accompanying figures in which:

Figure 1 is an overhead perspective view of a preferred embodiment peristaltic pump head comprising a rotor assembly and tube holder;

Figure 2 is a plan view of the pump head of Figure 1;

Figure 3 is a side sectional view of the pump head along line 3-3 of Figure 2;

Figure 4 is an overhead perspective sectional view of the pump head along line 3-3 of Figure 2;

Figure 5 is an overhead perspective view of a first preferred embodiment tube holder for use in the pump head of Figure 1;

Figure 6 is an underside perspective view of the tube holder of Figure 5;

Figure 7 is an exploded overhead perspective view of the tube holder of Figure 5;

Figure 8 is an exploded underside perspective view of the tube holder of Figure 5;

Figure 9 is an overhead perspective view of a second preferred embodiment tube holder for use in the pump head of Figure 1;

Figure 10 is an underside perspective view of the tube holder of Figure 9;

Figure 11 is a plan view of the tube holder of Figure 9; and

Figure 12 is an underside view of the tube holder of Figure 9.

DETAILED DESCRIPTION OF PREFERRED FORMS

With reference to Figure 1, the peristaltic pump head assembly has a main housing 1 carrying a rotor 3, which is received in a tube holder 5. The peristaltic pump head pumps fluid through a tube maintained in the tube holder 5, by the rotor compressing the tube and pushing fluid therethrough, this process known as occlusion. Two alternative preferred tube holders will be described below with reference to Figures 5-12.

As can be seen more clearly from the sectional views of Figure 3 and 4, the preferred rotor 3 is tapered and more particularly is substantially conical in configuration, with its tapered end extending upwardly from the housing 1. The rotor 3 has a main body part 7 and a head part 9 interconnected with the main body part, which head part 9 is mounted for rotation on a boss 11 extending upwardly within the housing. As can be seen most clearly in Figure 3, in side profile the head part 9 has a curved upper surface to enhance movement into the tube holder 3 when the components are brought together.

The boss 11 defines the axis of rotation of the rotor 3, and is substantially cylindrical or tubular and configured for receipt of a pusher 13. The head of the pusher 13 is biased against the underside of the head part 9 of the rotor by a biasing device 15, which is most preferably a compression spring coiled around a shaft of the pusher. The biasing device

biases the rotor 13 towards it tapered head end, and therefore towards the tube holder 5 in the assembled configuration.

As can be seen from Figure 3, a clearance is provided between the base of the pusher 13 and the base of the boss 11, and also between the base of the main body part 7 and the base of the housing 1. This enables the rotor 3 to move downwardly relative to the housing which allows it to automatically adjust within the floating tube holder as will be described.

A recess is provided in the rotor between the head part 9 and the main body part 7 for receipt of a number of rollers 17. In the preferred embodiment, three rollers are provided in an equally spaced configuration around the central axis of the rotor. However, it will be appreciated that the number of rollers can be varied as desired. The rollers 17 are substantially frustoconical in configuration, and are mounted for rotation on mounting members 19 which extend between the rotor main body part 7 and the head part 9. A corresponding number of inverted conical recesses 21 are provided in the main body part 7 of the rotor, for receipt of the enlarged conical bases 23 of the respective mounting members. Smaller recesses 25 are provided in the underside of the head part 9 for receipt of the upper ends of the mounting members.

A stop, which in the embodiment shown is an annular lip 26, extends outwardly from the main body part 7 of the rotor, which defines the upper limit of travel of the rotor 3 within the housing 1. When the rotor is not in contact with the tube holder, the spring 15 will bias the rotor upwardly until the lip 26 engages the underside of the housing 1. When the tube race 5, 105 is brought into contact with the rotor (as will be described below) that will push the rotor downwardly against the bias of the spring, so the lip 26 no longer engages against the housing 1.

During assembly of the rotor 3, the mounting members 19 and rollers 17 are mounted on the rotor main body part 7, and the head part 9 is attached to the main body part 7 to maintain the rollers in position in the rotor. The mounting members 19 define the axes of

rotation of the rollers 17 on the rotor, and it can be seen that these axes taper towards the head part 9 of the rotor. The included angles between the axes can be varied if desired.

A connector in the form of a pair of fingers extend from the base of the head part 9 and are receivable in the central aperture of the main body part 7, so that the rotor can snap together, thereby sandwiching the mounting members 19 and the rollers 17 for rotation between the main body part 7 and the head part 9. The assembled rotor can then be inserted on the pusher 13 and spring within the boss 11, and the upper and lower housing 1 parts can be snapped together. Accordingly, the entire assembly of the housing 1, rotor 3 and gears 55, 57 can be assembled without the use of any bolts, screws or adhesives. It is further preferred that the engagement between the tube holder 5, 105 and rotor is achieved without any fasteners, so the entire pump head assembly does not require the use of adhesives or separate fasteners.

A transmission mechanism generally indicated by reference numeral 51 is also provided in the housing for transmitting motive force to the rotor. In the embodiment shown, the outer perimeter of the main body part of the rotor includes a plurality of sprocket teeth 53. The teeth 53 are engaged with teeth on an intermediate gear 55, which in turn are engaged with the teeth of a drive gear 57. The sprocket teeth 53 around the base of the main body part are of sufficient length that they remain in engagement with the teeth of the intermediate gear 55 throughout the range of axial movement of the rotor within the housing 1. An aperture 59 is provided in the housing 1 and is aligned with the axis of rotation of the drive gear. A shaft can extend through the aperture 59 and engage the centre of the drive gear 57 to operably connect the drive gear to an electric motor (not shown) or similar. As shown in Figure 4, coaxial apertures are provided in the housing 1 above and below the drive gear 57, so that the shaft could enter the housing either above or below as desired. Similarly, the housing could be inverted so that a shaft below the housing engages the drive gear 57 from the upper aperture (orientation relative to the drawing) if desired.

The relative numbers of teeth on the gears could be selected to provided a desired up-speed or down-speed of the rotor relative to the input speed as desired. More or less gears could be used. Alternatively, an alternative transmission such as pulleys and bands or gears and chains could be used. An electric servo motor could be positioned within the housing 1 rather than, or in addition to, using a transmission mechanism.

All of the components are most preferably made of a suitable polymer plastic material, such as acetyl, ABS or similar. Such a configuration is advantageous as it means the components can be easily fabricated in large numbers such as by injection moulding, the apparatus will be relatively light weight, and corrosion of the components will not occur. It may however, be desirable to fabricate the spring from a suitable metal such as spring steel to provide the desired spring characteristics.

As can be seen from Figures 1 to 4, a tube holder 5 is positioned above the rotor 3. A first preferred tube holder 5 is shown in Figures 5 to 8. The tube holder has two parts, a base part 61 and a tube guide part 63 which together form a tube holder housing. The tube guide part 63 and base part 61 preferably snap together. The tube holder housing could be a unitary member if desired. The tube guide part 63 includes a tapered frustoconical recess 65 for receipt of the rotor 3 as shown in Figure 3 for example. A number of apertures 67a, 67b, 67c and 67d are spaced around the recess and define a first tube inlet 67a, first tube outlet 67b, second tube inlet 67c and second tube outlet 67d. The apertures and the recess define a tube race within which the tube extends around the recess when it is inserted in the tube holder.

The tube race has a first race part defined by the first tube inlet 67a, the first tube outlet 67b, and the surface of the recess therebetween. The tube race has a second race part defined by the second tube inlet 67c, the second tube outlet 67d, and the surface of the recess therebetween.

As can be seen from Figure 8, the underside of the tube guide part 63 includes a plurality of channels aligned with the apertures. In use, and with reference to Figures 5 and 8, a

tube is inserted into the housing through channel 69 and fed through first tube inlet aperture 67a. The tube is then extended around the surface of the recess 65 as far as first tube outlet 67b and out through the first tube outlet 67b, around channel 71, back into the race through second tube inlet 67c, around the surface of the recess 65 as far as second tube outlet 67d, out through the outlet 67d, over the part of the tube extending inwardly through channel 69 and back out of the housing through channel 73. It will be appreciated that the tube could be inserted through the housing in the other direction, ie in through channel 73 and out through channel 69 if desired.

The portions of the tube located against the surface of the recess 65 are occluded by the rollers 17 of the rotor 3 when the tube holder and rotor are in the configuration shown in Figure 3 and the rotor is rotated. The surfaces of the recess 65 against which the tube is seated provide occluding surfaces, with the tube being compressed between the rollers 17 and those surfaces.

By having the tube exit and re-enter the tube race as described above, movement of the tube in the axial direction of the rotor during use is inhibited, as the edges of the apertures 67a, 67b, 67c and 67d prevent significant axial movement of the tube. Further, as the rotors only act against discrete parts of the tube, that also serves to minimise longitudinal movement of the tube as the rotor rotates.

To provide additional stability to the tube in the holder, the inside of the tube holder base 61 includes a number of shaped projections 75, 77 and 79 which are located in channels 69, 71 and 73 respectively when the holder base part 61 and the guide part 63 are brought together. The projections may be sized such that there is limited clearance between the ends of the projections and the bases of the respective channels when the tube holder base part and guide parts are assembled, so that the tube is slightly compressed therebetween (such a configuration being shown in Figure 5). In this embodiment, the tube would need to be threaded into the guide part before the guide part is brought into contact with the base part. A number of protrusions 81 and apertures 83 are provided in the base part and the guide part to align the components.

However, it is not essential that the tube be slightly compressed between the base and guide parts, as it can be sufficiently held simply by exiting and re-entering the tube race. In the embodiment in which the tube is not compressed between the base and guide parts, those components can be assembled before the tube is fed into the housing.

Figures 9 to 12 show an alternative preferred tube holder 105. This tube holder is a unitary component, and again includes a tapered frustoconical recess 165 for receipt of the rotor 3 as shown in Figure 3. Rather than using apertures to define tube inlets and outlets, they are defined by a number of grooves. The grooves define a first tube inlet 167a, a first tube outlet 167b, a second tube inlet 167c and a second tube outlet 167d. The grooves and recess define a tube race within which the tube extends around the recess when it is inserted in the tube holder.

The tube race has a first race part defined by the first tube inlet 167a, the first tube outlet 167b, and the surface of the recess 165 therebetween. The tube race has a second race part defined by the second tube inlet 167c, the second tube outlet 167d, and the surface of the recess therebetween.

An outwardly extending projection or lip 107 is situated between the first tube outlet 167b and the second tube inlet 167c. The lip 107 is located above the level of the first tube outlet 167b and the second tube inlet 167c (in the orientation of Figure 9), and assists in maintaining the tube in the tube holder.

To load the tube into the tube holder, it is provided in a substantially U-shaped configuration and is moved in a direction substantially orthogonal to the tube race (ie downwardly in the orientation of Figure 9) such that the tube extends in through the first tube inlet 167a, around the surface of the recess 165, out through the second tube outlet 167b, in through the second tube inlet 167c, around the surface of the recess 165, and out through the second tube outlet 167d, as shown in phantom in Figure 11. This can be

achieved in a single orthogonal movement, and can be performed manually or by a machine.

The tube can then be pulled in the direction of first tube inlet 167a and second tube outlet 167d such that the base of the U-shape is located under the lip or projection 107.

Again by virtue of the tube exiting and re-entering the tube race, movement of the tube therein is inhibited. If desired, to provide additional stability to the tube in the tube race, the base of the grooves could be slightly enlarged relative to the upper portions of the grooves such that the tube is a snap fit into the grooves.

The portions of the tube extending around the recess 165 are occluded by the rollers 17 of the rotor 3 when the tube holder and rotor are in the configuration shown in Figure 3 as the rotor is rotated.

When the tube holder 105 is located in position on the pump head housing 1, the outer edges of the grooves 167a-d will be located against the surface of the housing 1.

One end of the tube will typically be fluidly connected to a source of fluid, and the other end of the tube will typically be fluidly connected to a delivery means such as a nozzle.

Either type of tube holder 5, 105 can be used in the peristaltic pump head. In the assembled configuration of the pump head and the tube holder, the tube holder 5, 105 will be floating relative to the pump head housing 1, i.e. limited movement transverse to the axial direction of the rotor will be provided. Limited axial movement of the tube holder can also be provided, which is compensated for by the biased pump head. For example, a tube holder carrier (not shown) may be provided containing a recess within which the tube holder can be placed, with limited axial and transverse movement of the tube holder relative to the carrier. The components can then be brought together so that the rotor extends through the recess in the tube holder, to pump fluid through a tube in the tube holder. The housing 1 could be attached to the carrier so that no movement therebetween

(but there would still be floating movement of the tube holder), but it is preferred that some floating movement is provided between the housing 1 and the carrier, to accommodate misalignment between the rotor and the tube holder.

By virtue of the transverse floating of the tube holder 5, 105 and the axial bias of the rotor 3, the pump head will be self aligning and self adjusting. The biased tapered rotor 3 will move the tube holder 5, 105 transversely if necessary so that it is aligned with the centre of the recess 65, 165. Further, the rotor will automatically move axially a sufficient distance that the rollers are located against the tube in the tube holder with a desired force determined by the spring characteristics. Therefore, the pressure applied to the tube by the rotor will be substantially constant.

The tube holders are preferably made from a polymer plastics material, such as acetyl, ABS or similar, and may be fabricated by injection moulding for example. The pump head can be made to a small size, with the dimensions of the main housing 1 being about 68 mm x 25 mm x 15 mm (at the deepest point shown), and the dimensions of the tube holder being about 30 mm x 25 mm x 7 mm for example. However, the pump head is fully scalable, and could be used to make much larger pumps. In larger pumps, the tube holder could be modified to have a greater number of race parts, ie the tube could be woven in and out of the housing a greater number of times than described above.

The preferred tube holder and peristaltic pump head described above have a number of advantages. In particular, the tube holders in which the tubes exit and re-enter the tube race maintain the tubes in a desired position in the race during a pumping operation. Further, by virtue of the tube holder being mounted to float transversely relative to the tapered rotor, the rotor and tube race are self-aligning. By axially biasing the rotor, the floating tube holder and the rotor as also self-adjusting to maintain the desired pressure on a tube in the tube race.

The above describes preferred embodiments of the present invention, and modifications may be made thereto without departing from the scope of the invention.

For example, it is not essential that the rotor is axially biased, nor that the tube holder is floating relative to the main pump housing. However, including those features provides the advantages outlined above.

What we claim is:

1. A tube holder for use in a peristaltic pump, the tube holder including:
a housing defining a recess for receipt of a pump rotor, a tube race for receipt of a tube defined around the recess and having a first race part around one part of the recess and a second race part around another part of the recess, a first tube inlet into the first race part and a first tube outlet from the first race part, a second tube inlet into the second race part and a second tube outlet from the second race part;
the tube being insertable in the tube race by movement in a direction substantially orthogonal to the tube race so that it extends in through the first tube inlet, around the first race part, out through the first tube outlet, in through the second tube inlet, around the second race part, and out through the second tube outlet.

2. A method of assembling a peristaltic pump head including:
providing a tube holder having a housing defining a recess for receipt of a pump rotor, a tube race for receipt of a tube defined around the recess and having a first race part around one part of the recess and a second race part around another part of the recess, a first tube inlet into the first race part and a first tube outlet from the first race part, a second tube inlet into the second race part and a second tube outlet from the second race part;
providing a tube; and
moving the tube in a direction substantially orthogonal to the tube race such that it extends in through the first tube inlet, around the first race part, out through the first tube outlet, in through the second tube inlet, around the second race part, and out through the second tube outlet.

3. A peristaltic pump head assembly including:
a tapered pump rotor rotatably mounted in or on a pump head housing and which is rotatable about an axis of rotation relative to the housing; and
a tube holder including a recess in which the pump head is receivable and including a tube race for receipt therein of a tube for pumping of a fluid by movement of the rotor;

the tube holder mountable to the pump head housing so it can float in a direction transverse to the axis of rotation of the rotor, the pump rotor and tube race self-aligning as a result of the tapered rotor extending into the recess of the floating tube holder.

4. A peristaltic pump head assembly including:
a tapered pump rotor which is rotatable about an axis of rotation; and
a tube holder including a recess for receipt of the tapered end of the rotor, and a tube race for receipt therein of a tube for pumping of a fluid by movement of the rotor, the tube race including a plurality of separate race parts around the recess defined by a plurality of apertures or recesses such that the tube can exit and re-enter the tube race

5. The combination of a pump rotor rotatably mounted in or on a pump head housing and which is rotatable about an axis of rotation relative to the housing; and
a tube holder including a recess in which the pump head is receivable and including a tube race for receipt therein of a tube for pumping of a fluid by movement of the rotor;
the pump head housing and tube holder being fully separable from an operable configuration in which the pump head is located in the recess of the tube holder and configured to pump fluid through a tube therein to a loading configuration in which the tube may be loaded into the tube race.

6. A kit of parts for assembling a peristaltic pump head assembly, including:
a rotor and a housing having first and second housing parts and configured for receipt of the rotor;
which rotor may be maintained in the housing by snapping the housing parts together such that the pump head assembly can be assembled without the use of adhesives or separate fasteners.

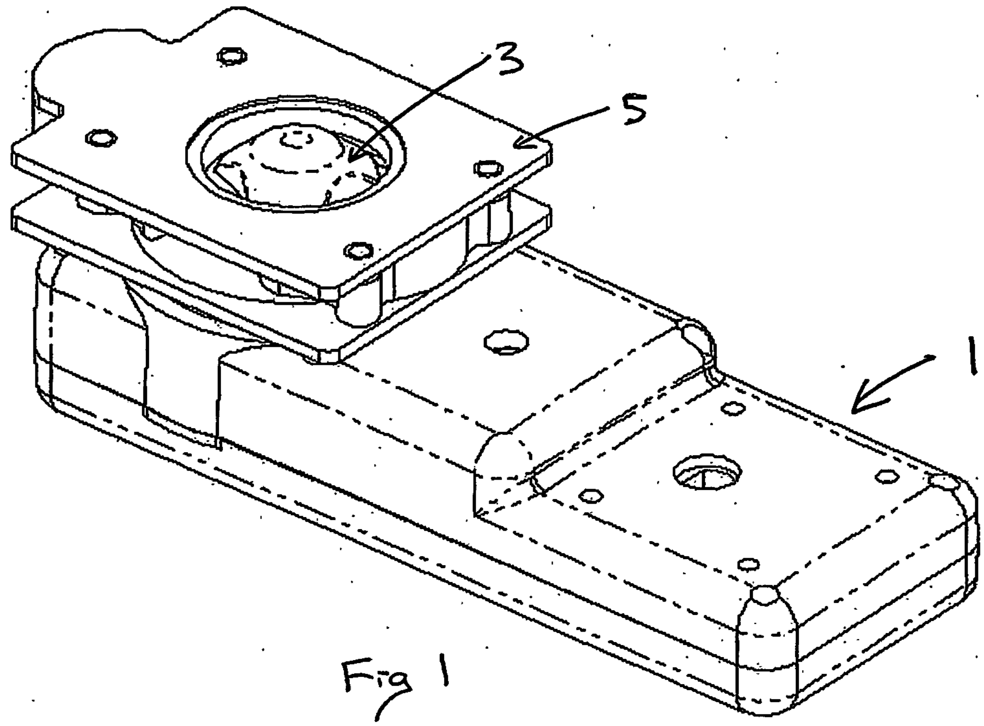

Fig 1

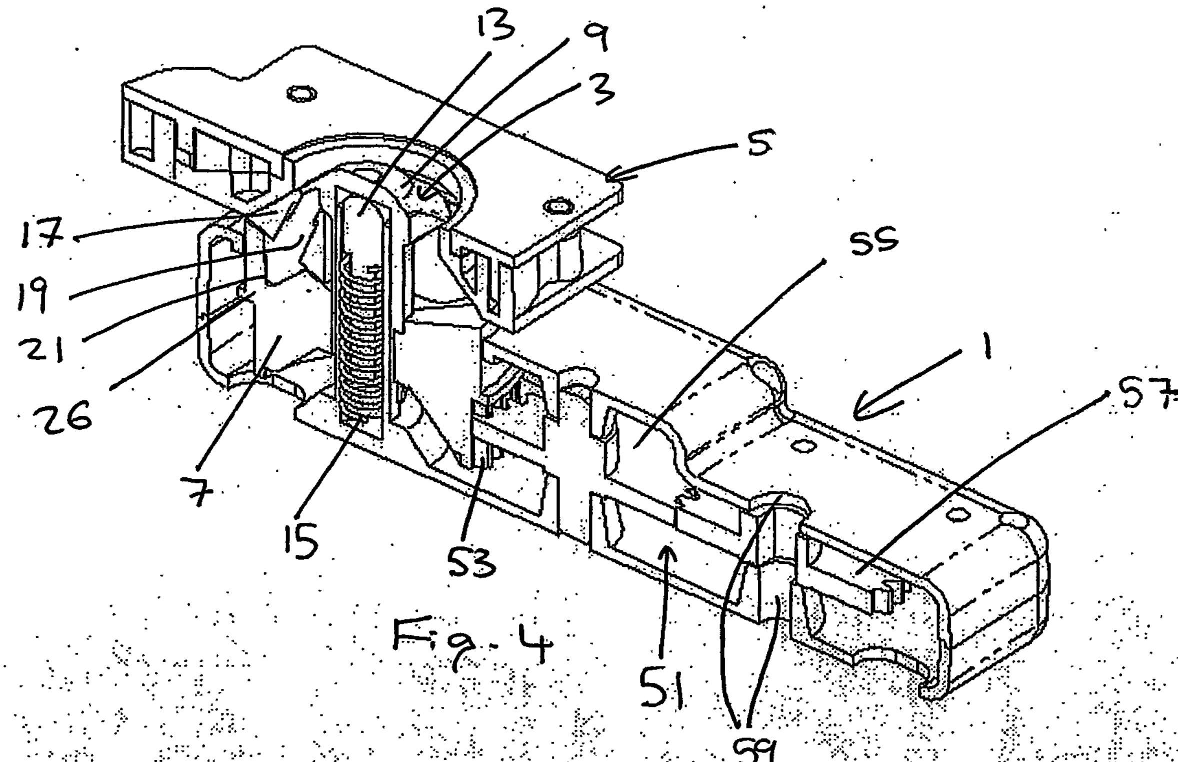

Fig. 4

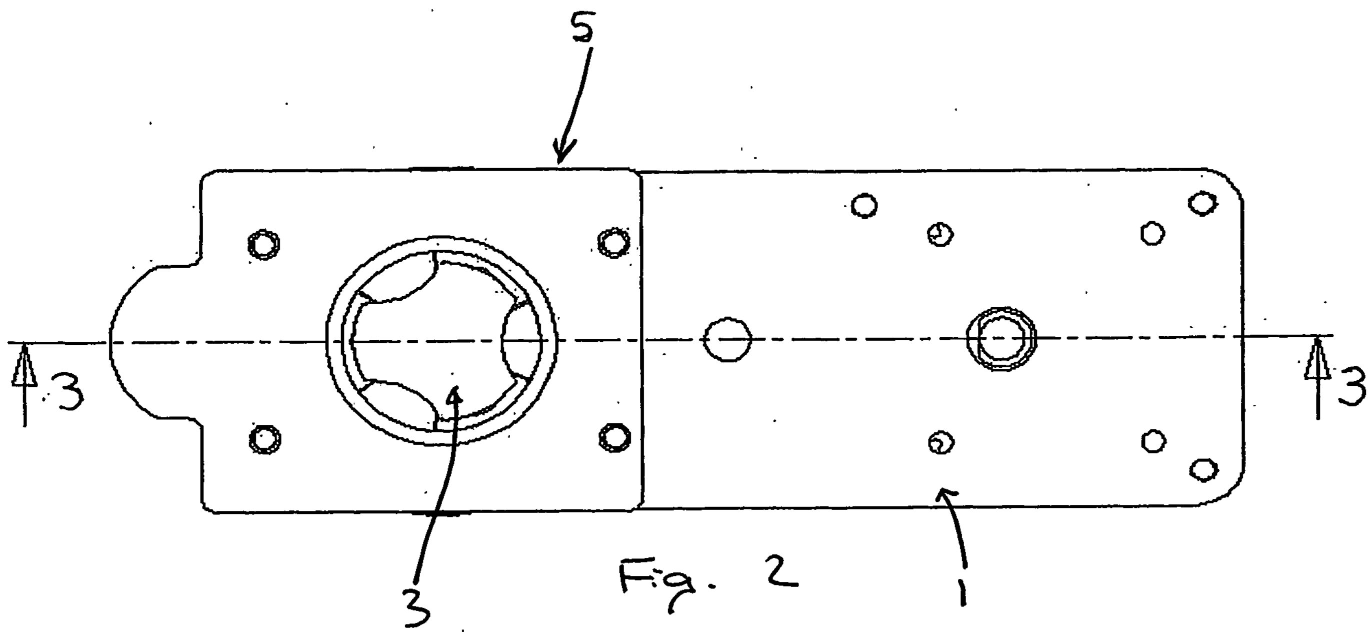

Fig. 2

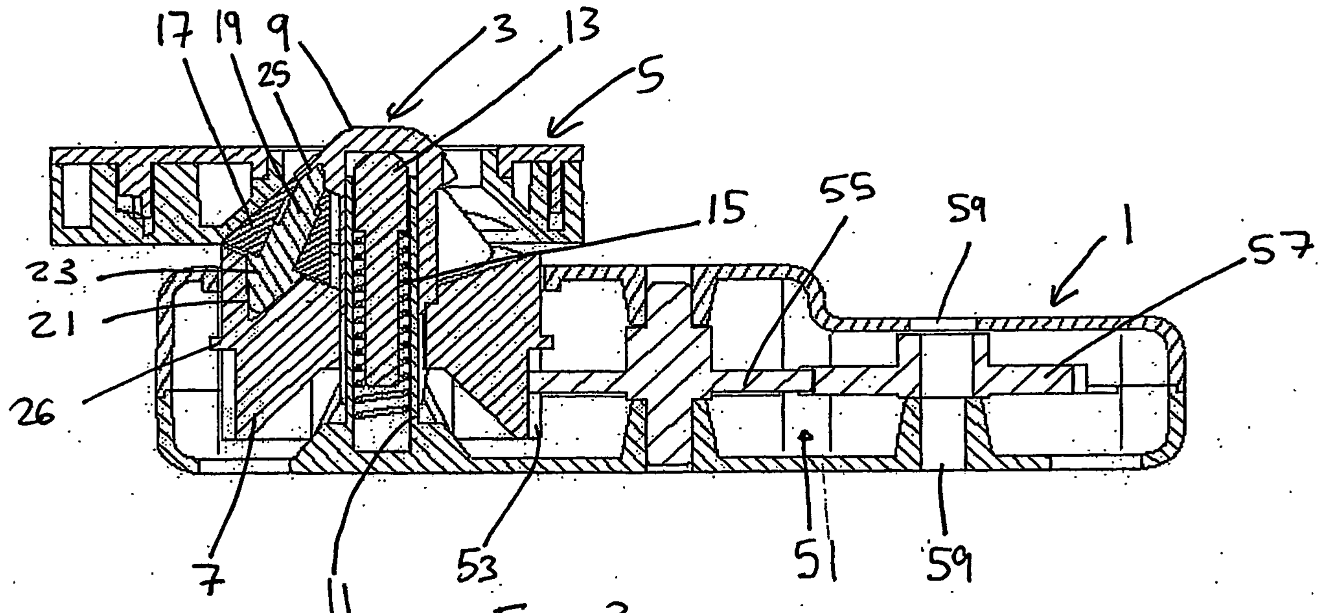

Fig. 3

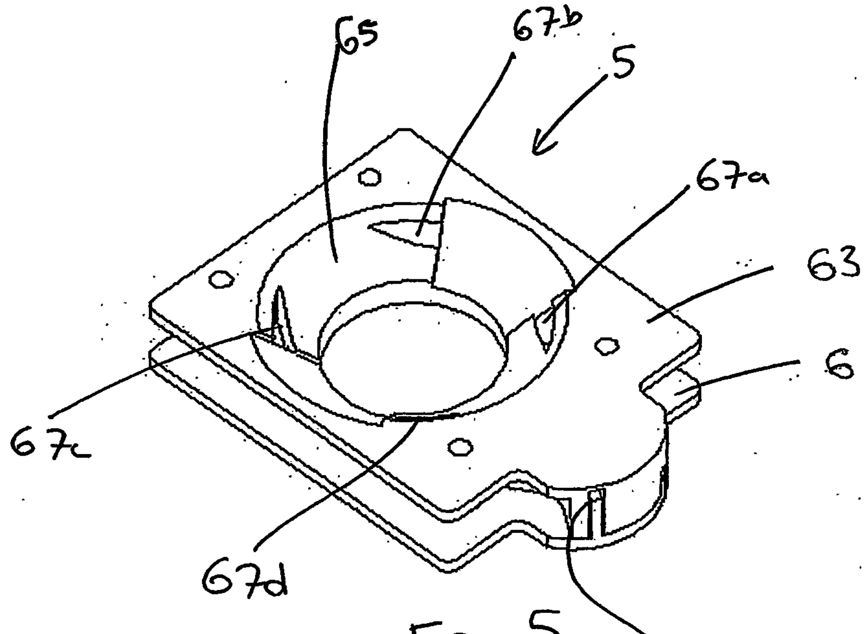

Fig. 5

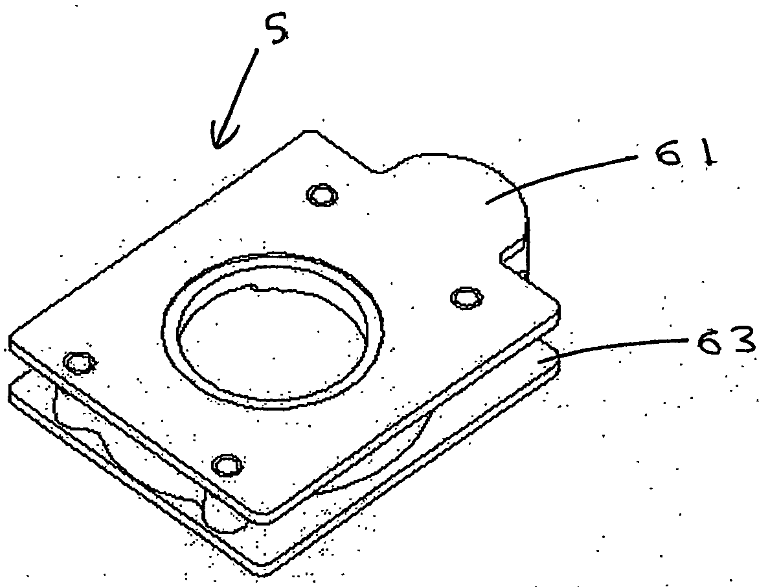

Fig. 6

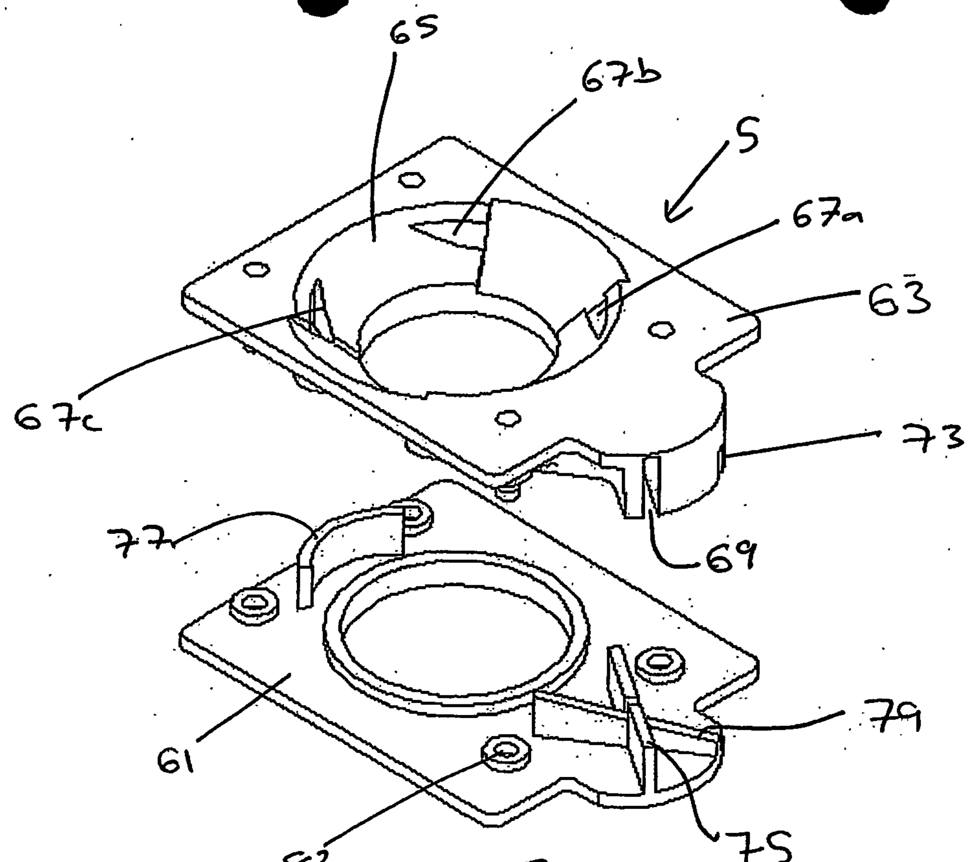

Fig-7

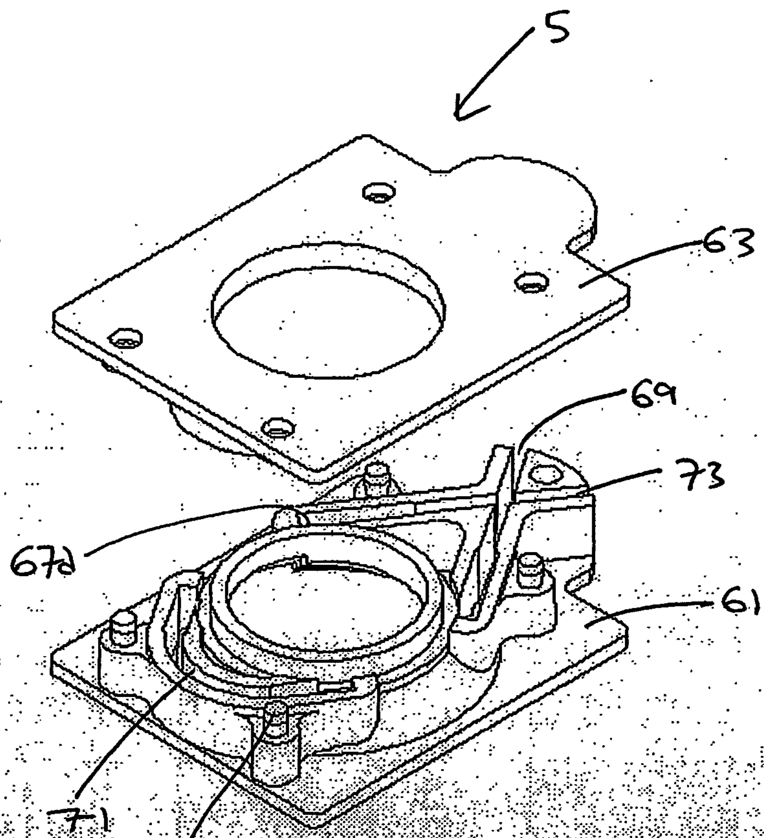

Fig 8

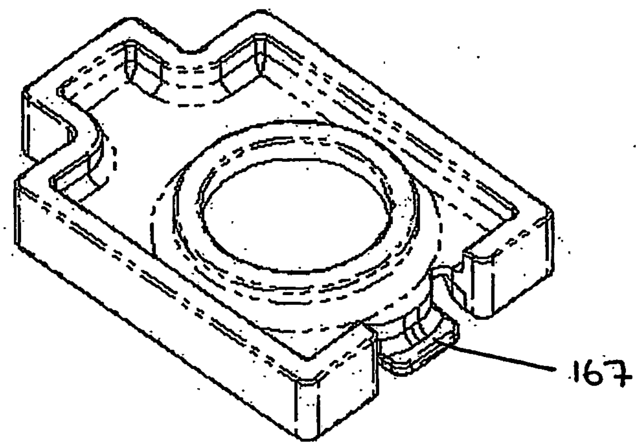

Fig. 10

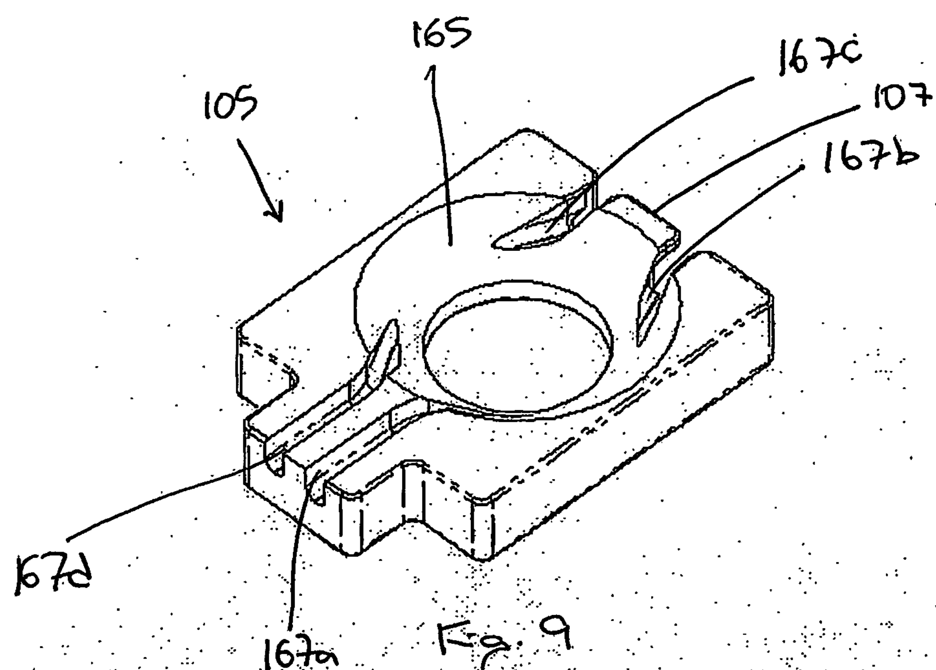

Fig. 9

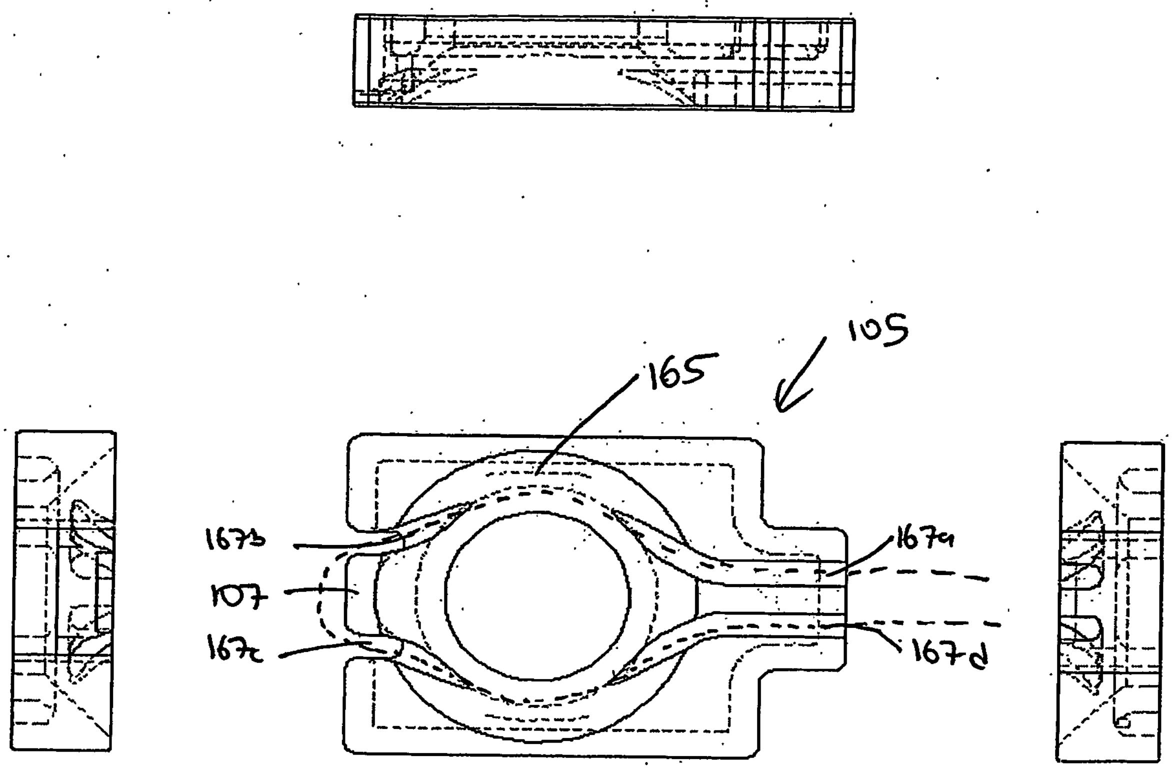

Fig. 11

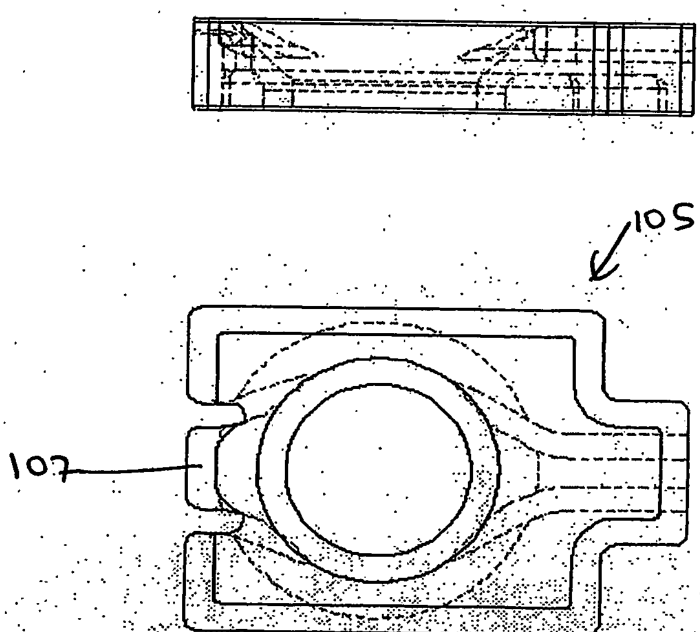

Fig. 12